EPA responses to Preliminary Comments from the CCT on the Upper Columbia River Draft Quality Assurance Project Plan for the Phase 2 Sediment Study

General Comments [*The following section provides EPA's draft general comments on Teck's draft Phase II sediment QAPP. Items still under discussion are clearly noted as such, and EPA's current thinking and the status of discussions with the PPs on topics related to the QAPP are summarized. Where appropriate, these comments will be rephrased to make them directive.*]

1) **General –** The revised sediment QAPP should include a section describing the DQOs that explains how this QAPP fits into the BERA workplan and the Problem Formulation Plan, and illustrates which receptors/pathways are covered by the proposed investigations by referring to the CSM.

2) **Sampling Locations** - Teck's use of an mPECQ of 2 is inadequate to identify samples with a high probability of toxicity and EPA will direct Teck to use an alternative design for Round 1. The sampling proposal in development by the PP / EPA work group employs a less random approach than Teck's to improve the likelihood of sampling success (i.e., avoiding areas with large grain size and hard substrate) and includes samples in areas with an mPECQ > 5. EPA is waiting to see the group's final suggested sample locations, but is inclined to go with the group's suggestions and direct revisions to the QAPP to adopt the locations proposed by the work group. EPA does not agree with the suggestion to sample the upper / northern section in Round 1 and the lower / southern section in Round 2, and will direct Teck to sample across the site in Round 1. EPA prefers sampling across the whole site in Round 1 for two reasons. One, it will eliminate a possible source of uncertainty (variability between sampling events being mistaken for true geographic differences in toxicity) and two, it allows for the possibility of completing benthic risk assessment after Round 1 (if a good dose response is found, no additional sampling would be needed for risk assessment purposes). It is understood, however, that Round one sampling is based on informed guesswork and the chemical composition of samples will not be known until after they are collected. This uncertainty requires that the site investigation process is an iterative one, where the initial rounds of data inform subsequent sampling rounds and the final determination is data driven. The need for DQOs and decision criteria that will guide the determination of any Round 2 sampling is described in GC-5.

3) **Sediment Sampling Methods** - EPA considers it feasible for Round 1 to collect samples from depositional areas. EPA is waiting to see the final approved sample locations, but is inclined to go with the sample placement work group's recommendation and direct Teck to amend the QAPP to adopt the locations proposed by the work group. This should result in a higher success rate because local expert knowledge is being used to hand-place samples in areas where sampling success is more likely, and because a generous number of alternate locations will be included. EPA has a strong preference for surface samples that can be collected without removing the heavy cobble armoring layer present in much of the upper portion of the site. Alternative sampling procedures other than the power assisted Van Veen proposed by Teck can be considered and used in Round 2, as informed by Round 1 sampling results.

4) **Pore Water Sampling:** DQOs describing the goals of field collected pore water and lab pore water collections will be included in a revised QAPP. EPA is willing to consider pore water data collected using the air stone method proposed by Teck as a possible measure of exposure for field invertebrates (i.e., field pore water). However, this is a non-standard method and it has shown some potential for bias over other methods (i.e., concentrations of lead were lower than from peepers, DGTs, and known concentrations in spiked water; White Sturgeon Methods Development Data Summary and Evaluation [Teck 2010]). Therefore, concentration-response relationships in laboratory exposures will be assessed using pore water collected from peepers in chemistry-only bioassay test beakers for each sediment sample. Analytes not determined from peepers in laboratory bioassays will be measured in pore water extracted via centrifuge from splits of homogenized sediments prepared for bioassays. Comparisons between laboratory and

field concentrations will need to be discussed further, when data are available and after exploratory relationships have been analyzed.

5) **Number of Bioassay Samples/Phasing**: A DQO describing the purpose of sediment samples and toxicity testing must be included in the revised QAPP, including the approximate total number of samples expected to meet the DQOs, while recognizing that the final determination will be data driven. EPA continues to expect that 100-130 paired bioassay/chemistry samples representing a range of concentrations and conditions may be needed to develop concentration response relationships. EPA remains hopeful that the 2005 samples can be included in this analysis. EPA will direct Teck to use an alternative design for Round 1 (see General Comment 2). The revised QAPP will need to describe the factors (i.e., inputs to the decision) and decision criteria that will be considered in determining whether Round 2 samples are needed to fill any identified data gaps.

6) **COPC Refinement**: EPA will direct Teck to develop a revised COPC refinement in a separate technical memorandum. EPA's primary concern with Teck's COPC refinement is that it considers only risks to benthic organisms. EPA wants to see the refinement of COPCs done by media, rather than by receptor so that the resulting data can be used in the assessment of multiple assessment endpoints. Teck has already been asked to develop a spreadsheet of media-COPC-receptors to track COPC refinement, to ensure that sampled media will be analyzed for all COPCs that have not been excluded as risk drivers for all Assessment Endpoints. EPA's draft direction to Teck will be shared with the Participating Parties for review and comment before going to Teck.

7) **Slag characterization:** The revised Phase II sediment QAPP will include a DQO for characterizing slag in sediment samples. One or more methods may be needed as indicators of slag in each sample. These measures will be used, as needed, as explanatory variables in the evaluation of lab-based toxicity data. EPA's evaluation of the 2005 toxicity data indicated the explanatory utility of a measure of the presence and/or amount of slag in each sample. Chemicals that may be used to characterize slag (e.g., Zn, Cu, Fe, and Ca) will be included in sediment analyses, even if they would otherwise be eliminated in the COPC refinement process. EPA will require Teck to evaluate multiple ratio methods following the collection of Round 1 data, and to archive sediment from all Round 1 samples for additional slag characterization in case the ratios do not appear to provide sufficient distinction between the slag content of various samples. EPA will determine the need for additional, more precise measurements of slag following the initial dose-response evaluation by Teck and any TIE evaluations. The QAPP will describe this process generally and acknowledge that EPA may require more precise empirical evaluation methods, such as electron back scatter scanning electron microscopy to be run on archived samples.

8) **Sieving**: There are certainly sediments in the UCR with particle sizes > 2 mm. However, this does not mean that sieving must be done to test sediments with < 2 mm particles. A DQO for the targeted sediment particle size will be included in the revised QAPP. This DQO will describe the use of sediment of a consistent size fraction relevant for biological exposure and chemical measures (i.e., < 2 mm). EPA expects Teck to obtain sediments <2mm and will ensure this is achieved through close field oversight of Teck's sampling. A qualified person will visually estimate the percentage of material <2mm as samples are retrieved, and to select / retain sediment that contains at least 25% of the <2mm size fraction. Additional field processing will depend on the sample and may vary across the site. Samples of fine grained material with no particles >2mm will be retained with no additional sorting. Samples that are mostly fine grained materials with some larger pieces of gravel or debris will have the larger pieces of gravel or debris removed by hand. Samples that have a large amount of materials >2mm will be coarsely sieved in the field with a 5 mm sieve. Samples where more than 75% of the sample is material >2mm will be rejected.

9) ***H. azteca* test duration** - The rationale f*or 10-day* test with *Hyalella azteca* is not clear. EPA will require 28-day toxicity tests with *Hyalella to* be conducted on all bioassay samples.

10) **Bioaccumulation**: Tissue from the 28 day *Hyalella* toxicity tests will be retained and analyzed for COPCs. Extra exposure beakers may be needed to produce sufficient tissue volume. Timing, sample holding times, method details (blotting, depuration, etc…) will be determined through discussion with experts and detailed in an SOP in the QAPP. Tissue concentrations in *Hyalella* will support interpretation of sediment toxicity tests. Although CBRs will be calculated if supported by the data, CBRs would be a secondary line of evidence because the actual measured adverse effects in the bioassays is a direct line of evidence and is therefore more reliable than a CBR model. (NOTE: this issue is the subject of a dispute between EPA and Teck and this response may change depending on the outcome of the dispute.)

11) **TIE Triggers**: There is a reasonable expectation that observed toxicity will be attributed to elevated metals in sediment and/or pore water. However, if unexplained toxicity is observed, it will be further explored using TIE testing. Factors that would trigger TIE testing need to be generally described in the revised QAPP. If TIE testing will be used, Teck will develop a technical memorandum that explains in detail which samples they plan to test, why, and the procedures they will use. TIE testing will not begin before EPA has approved the technical memorandum. To the extent that toxic samples are consistent with predictions of toxicity (e.g., there is a good dose-response with metals; effect concentrations are consistent with other studies), then EPA will not require Teck run TIE tests. The purpose of TIEs is to explain toxicity in samples where the cause of toxicity is not clear. TIEs could include evaluation of grain structure or other possible toxicants. Less toxicity will mean it is less likely a TIE will be successful in identifying the toxicant, so EPA will not require Teck to investigate marginally toxic samples.

12) **Lab performance:** EPA needs to be confident in the ability of Teck's bioassay laboratory to appropriately run the selected tests, including the less commonly used reproductive endpoint tests. EPA will request additional information about the performance of Teck's selected lab(s) in a letter, separate from the QAPP comments. After reviewing lab performance information, EPA may require a lab visit or audit before agreeing to the laboratory selection.

Elements required to be provided by the lab selected by Teck to conduct sediment toxicity testing (as listed in the Sediment LOE) include:

- Control charts for each combination of reference toxicant and test organism. Each control chart should include a minimum of the five most recent 96-h water-only reference-toxicity tests to assess the sensitivity of culture organisms. Survival, growth, or reproduction of the test organisms from these preliminary studies will demonstrate whether facilities, water, control sediment, and handling techniques are adequate to result in acceptable species-specific performance.

- Control sediment test data for a minimum of the 5 most recent tests of each proposed test and species.

- Sources of test organisms with documentation of organism quality from reference toxicity tests at the culturing facility if not produced in-house.

Elements recommended if available but not required to be provided by the selected lab are:

- Documentation demonstrating that lab personnel are able to recover an average of at least 90% of the organisms from whole sediment (i.e., control data).
- Intra-laboratory precision (within the same lab), expressed as a coefficient of variation (CV), of the range for each type of test to be used in a laboratory can be determined by five or more tests with different batches of test organisms, using the same reference toxicant, at the same concentrations, with the same test conditions (for example, the same test duration, type of water, age of test organisms, feeding), and same data analysis methods.
- Source of control sediments and chemical makeup.
- Source of laboratory control/overlying water and its chemical makeup.

General Comments

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1	CCT-0	Teck should be requested to address applicable LOEs directly in this and in future QAPPs, in order to facilitate reasoned scientific dialogue about the relative merits of different approaches.	Teck will be required to make the revised QAPP consistent with the Problem Formulation revisions issued by EPA. However, complete consistency with the LOE is not a requirement. When the Sediment LOE was delivered to Teck in 2010, the term LOE had not been defined in writing and understanding of what the term meant and how directive the LOE was intended to be varied widely between EPA staff, the Participating Parties and Teck. Since the term LOE has been defined (7/6/11), this misunderstanding should not occur again and for future sampling programs, EPA will require Teck to justify deviations from the LOE. That mutual expectation was not in place when the Sediment LOE, the draft QAPP, or DOI's comments were prepared. EPA does not find deviations from the LOE to be automatically "unacceptable." Technical discussions and new data that have become available since the development of the LOE have informed EPA's current thinking on parts of the QAPP.	-
2	CCT-1	Teck has proposed an approach whereby it would endeavor to collect 50 sediment samples during the first sample collection effort ("Round 1"). However, they only plan to conduct bioassays on a subset of these samples, and have designated 20 samples "chemistry-only." In no place in the QAPP do they explain the intent of conducting "chemistry-only" sampling, and the EPA LOE clearly contemplates that over 100 sediment toxicity samples will be necessary at a minimum to build a sound chemistry-toxicity relationship. Therefore, it would be most appropriate if Teck performed bioassay tests on all sediment samples collected during this "Round 1" effort, because all of the potential "bins" of sediment chemistry measures are as of yet empty and need to be filled. (pp. A-9 and B-4)	EPA agrees with CCT that a DQO describing the purpose of chemistry-only samples must be included in the revised QAPP. EPA will require Teck to include more details in the revised QAPP describing DQOs for the sediment sampling and the expected number of samples needed to meet those DQOs, while recognizing that the final determination will be data driven. EPAs recommendation to target 100-130 samples representing a range of concentrations and conditions is expected to support the development of concentration response relationships (see GC-5).	Include a DQO for collecting chemistry-only samples. The number of samples that will only be analyzed for chemistry (not for toxicity testing) and the purpose of these chemistry-only

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				samples need to be clearly described.
3	CCT-2	Bioassay tests to be performed should be harmonized with changes to the Problem Formulation Work Plan recently agreed to as part of the dispute resolution process initiated by the CCT.	EPA agrees. Bioassays performed will be consistent with the BERA workplan and the Problem Formulation Plan (see GC-1 and GC-9).	-
4	CCT-8	Control sediment for bioassay tests should be addressed explicitly in the QAPP.	EPA agrees that control sediment data from the proposed lab is needed and will be requested as part of a request for information (see GC-12). This information will be used to evaluate the proposed lab capabilities for testing.	-
5	CCT-10	In no section of the sediment QAPP is the issue of quantification of slag addressed (as requested in the EPA LOE). Quantification of slag is important in the context of sediment toxicity studies because of the possibility that it will be an important correlative factor when determining the relationship of sediment chemistry to benthic toxicity. We request that an empirical slag quantification method be required for inclusion in this QAPP.	EPA agrees with CCT that additional information regarding the DQO, methods, and rationale for characterizing slag need to be provided in the revised QAPP. An estimate of the slag content of sediment samples may improve correlations between chemistry and toxicity, as part of an ANOVA or principal component analysis, or by allowing the data to be divided into slag dominated and non-slag dominated sediments. EPA plans to meet this DQO through the use of metal ratios developed from the chemistry data. If good correlations are not observed, more precise measurement of slag content may be required, and archived sediment will allow for this more precise measurement if needed (see GC-7). The goal of this QAPP is not to define the nature and extent of slag contamination. The goal is to allow development of concentration-response relationships that can be used to evaluate the nature and extent of risks. This is consistent with the LOE goals, and the inclusion of new DQOs and other revisions (see General Comments), will be adequate to meet those goals.	-

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6	CCT-13	The Department of the Interior has made numerous and detailed comments (April 15, 2011) regarding performance of the bioassay tests, as well as many other aspects of this QAPP, and the CCT support those comments and concerns raised.	EPA discussion in response to DOI comments were provided to DOI and PPs on 12/30/11.	-

Specific Comments

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2	CCT-3	-	A-10 and B-6	More details should be provided regarding the decision timeline for toxicity identification evaluation (TIE) testing. If all samples are to move directly into TIE testing that should be stated, otherwise the decision criteria for whether a sample will be subjected to TIE testing should be described. All that is present now are two short, vague sections (pp. A-10 and B-6).	EPA agrees that the TIE discussion in the QAPP is inadequate, but believes it is impossible to specify ahead of time which samples will be appropriate for further exploration using TIE tests. EPA will require Teck to describe the factors that that would trigger TIE testing in the revised QAPP. If TIE testing will be used, Teck will develop a technical memorandum that explains in detail which samples they plan to test, why, and the procedures they will use. TIE testing will not begin before EPA has approved the technical memorandum (see GC-11).	-
3	CCT-4	A7.4.1; Appendix D	A-10	We understand that references to juvenile mussel (*Lampsilis siliquoidea*) toxicity testing will be harmonized with the results of the ongoing Problem Formulation Work Plan dispute resolution process. We recommend removing section A7.4.1 (p. A-10) and Appendix D from this QAPP regardless of the dispute resolution decision.	EPA agrees with CCT and will comment to Teck that these sections will be deleted from a revised QAPP.	Remove Appendix D from the QAPP and remove references to Appendix D from the text.
4	CCT-5	A7.5.1	A-12, lines 16	The following should be removed: "this will provide a line of evidence that metals are not	EPA disagrees. The lack of a reduction in toxicity when TIE procedures to reduce	-

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			and 17	causing the positive response seen in the bioassay."	metal toxicity are implemented is one line-of-evidence that metals are not toxicity drivers. It is not a definitive argument, but this would be a valid indicator of toxicity due to other classes of toxicants.	
5	CCT-6	A7.6.1 and B1.1	A-14 and B-1	In the past, Teck has had difficulties obtaining samples in the riverine section of the site. Our suggestions are twofold. First, many more reserve locations should be identified so that they can be cleared through cultural resource review and used without delay if necessary. Second, when choosing reserve locations, some should be located within the area exposed during average-year drawdown (in the dam-affected areas) or below the high-water line in the furthest upstream areas. These areas, when exposed, can be sampled even if armored by cobbles, by removing the large rocks from the surface layer and hand-sampling beneath. It should not be a prerequisite that sediment samples be taken from areas underwater at the time of sampling, only that they be inundated regularly. Further, this would address a component of the LOE otherwise not addressed by Teck in this sediment QAPP, namely, "Samples should include some targeted sediment collected from under cobble and interstitial spaces between cobbles. This is particularly pertinent since large deposits of slag have been found trapped under and between cobbles. These interstitial spaces serve as important habitat for aquatic organisms, and no evaluations have been done that would determine whether the slag found under cobbles is different from slag found in other substrates" (EPA LOE).	EPA is waiting to see the final approved sample locations, but is inclined to go with the group's recommendation and direct Teck to amend the QAPP to adopt the locations proposed by the work group. This should result in a higher success rate because local expert knowledge is being used to hand-place samples in areas where sampling success is more likely, and because a generous number of alternate locations will be included. Currently, EPA considers it feasible for Phase I sampling to collect from depositional areas where sediments are representative of those found in some areas that may be challenging for collection, such as under cobbles and around boulders. Alternative sampling procedures can be considered and used in Round 2, as informed by Round 1 sampling results (see GC-3).	Pending sample location workgroup discussions with PPs.

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6	CCT-7	A8	A-16	On page A-16, section A8 talks in nonspecific terms about requirements of a bioassay laboratory. If Teck has selected a laboratory to do this work, their credentials should be attached to the QAPP, and if not, the credentials should be appended in a QAPP amendment once the laboratory is selected.	The proposed bioassay lab is indicated in Section A4.2.4 and credentials are provided as part of Appendix G. EPA agrees with CCT on the need to understand laboratory performance to a greater degree than is possible from the information provided. Information requirements for evaluating laboratory performance will be required of Teck, separate from the QAPP, before EPA approval of Teck's laboratory (see GC-12).	-
7	CCT-9	B1.1	B-1 and B-2	An insufficient number and variety of reference locations have been selected and for the external reference locations that have been selected, no evidence has been presented that they fulfill any of the requirements spelled out on pages B-1 and B-2 other than the qualitative ones. Specifically, data should be shown illustrating that the proposed locations have sediment that has a similar grain size distribution and TOC to UCR sediment. A complication is that there is no one measurement for these factors for "UCR sediment" and so enough reference locations to provide a range of conditions will be needed. Further, there is a requirement that reference sediment be uncontaminated or minimally impaired, and data from samples taken near the proposed locations should be shown in order to allow reviewers to evaluate this dimension of sediment quality. Further, evaluation also requires criteria with which to evaluate – that is, levels of metals which can be agreed to constitute a lack of contamination or "minimal impairment," which may require accelerating discussions of what levels of metals constitute "background" in sediments of the	Specific direction regarding sample locations and methods are under discussion between EPA and PPs and will be provided to Teck. These discussions include hand-placing some samples to target specific areas of concern (see GC-2 and GC-5). The need to review and discuss reference samples should be a part of these discussions. Teck's QAPP proposes to collect reference samples upstream of the Trail smelter and to consider internal reference locations that meet reference envelope criteria. These are reasonable. EPA will direct Teck to explain their approach for evaluating internal reference samples. Using subsurface sediment obtained from core samples to compare to surface samples introduces additional uncertainties. For example, subsurface sediments are anoxic which affects metal speciation, it would require multiple cores to generate sufficient volume, and porewater sampling could not be conducted using same methods used for surface sediments. EPA would consider	Include text describing how potential internal reference sites will be evaluated and selected.

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				UCR and Lake Roosevelt. Related to but distinct from the issue of determining background levels of metals, a specific suggestion we have for additional sediment that can be compared as a reference to upstream/riverine samples is to take several cores in the vicinity of those previously taken by the CCT (coordinates can be provided) and to use the uncontaminated sediment beneath the slag-impacted sediment. In many locations this uncontaminated sediment was found less than 3 feet below the sediment-water interface and was not difficult to access or identify visually.	using subsurface core samples for reference only if they could not be obtained using other methods.	
8	CCT-11	A7.3.1, B4.1, B4.2	A-8, B-8, B-9	Teck proposes to use airstones to collect porewater immediately after sediment samples are collected. However, in testing airstones during the juvenile sturgeon sediment toxicity tests, the University of Saskatchewan found that the airstones were likely having a direct effect on levels of lead measured in the water collected through them. If airstones are to be used in this sample collection effort, Teck should address how it will overcome this problem.	EPA agrees that the methods for collecting and analyzing pore water need to be clarified in the revised QAPP (see GC-4). Specifically, DQOs for field and lab pore water need to be defined, supplemental field methods (i.e., centrifuged) need to be included, details of laboratory pore water collections from peepers and (as needed) centrifuged from homogenized sediment, need to be detailed.	-
9	CCT-12	A7.3.1	A-8	Also with respect to airstones, on page A-8 a brief description of the airstone sampling method is given. Teck should provide details of the procedure anticipated if multiple grabs at one location are necessary to collect the large volume of sediment needed. Would multiple porewater samples be taken, one from each grab? Of what volume? Etc.	EPA is willing to consider pore water data collected using the air stone method proposed by Teck as a possible measure of exposure for field invertebrates (i.e., field pore water). However, concentration-response relationships in laboratory exposures will be assessed using pore water collected from peepers in chemistry-only bioassay test beakers for each sediment sample. Analytes not determined from peepers in laboratory bioassays will be measured in pore water extracted via centrifuge from splits of	

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					homogenized sediments prepared for bioassays. Comparisons between laboratory and field concentrations will need to be discussed further, when data are available and after exploratory relationships have been analyzed.	
10	CCT-App-B-1	Appendix B		In addition to the inorganic analytes recommended for analysis (Cd, Cu, Pb, An, As, Cr, and Ni), an additional 11 analytes should also be measured in all media (Al, Ag, Be, Mn, Nb, Sc, Se, Ta, Tl, Th, and U). Specific comments, including the basis for including the additional metals, follow below:	EPA will direct Teck to develop a revised COPC refinement in a separate technical memorandum. EPA's primary concern with Teck's COPC refinement is that it considers only risks to benthic organisms. EPA wants to see the refinement of COPCs done by media, rather than by receptor so that the resulting data can be used in the assessment of multiple assessment endpoints (see GC-6). Teck has already been asked to develop a spreadsheet of media-COPC-receptors to track COPC refinement, to ensure that sampled media will be analyzed for all COPCs that have not been excluded as risk drivers for all Assessment Endpoints. EPA's draft direction to Teck will be shared with the Participating Parties for review and comment before going to Teck.	-
11	CCT-App-B-1	Appendix B, 3.1.3, 3.3	B-9 and B-11 through 14	Section 3.1.3/Section 3.3. The "relative toxicity" approach for eliminating analytes is not appropriate. If there is documented precedent for using the relative toxicity approach it should be presented. Just because elements are lower in the relative toxicity scale does not mean they are not toxic, i.e. there are no benchmarks to which to compare them to. Based on Figure B3-2, we would not agree that scandium (Sc) and manganese (Mn) have relatively low toxicity compared to zinc (Zn), as stated on page B-	EPA agrees that eliminating COPCs from further evaluation based on risks relative to other metals is inappropriate in the COPC refinement. Comment will need to be addressed in the revised COPC refinement Technical Memorandum (see GC-6).	Do not exclude COPCs that were excluded based on relative risk. COPC refinement will not be based on relative toxicity of COPCs but on approved EPA procedures.

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				13, lines 11-14; Zn is ranked ~12, while Sc and Mn are 9 and 14, respectively. Additionally, cerium (Ce) is 19; yttrium (Y) is 25. Please provide some protocol and scientific basis for selecting the cutoff for "…relatively low toxicity in comparison to elements such as copper, lead or zinc."		
12	CCT-App-B-1	Appendix B, 3.3	B-13, lines 14-17	If porewater exceedances, for example for Al and Mn " may be affected by confounding factors…" then these metals should be included in further analysis, rather than excluded based on factors that are uncertain and not explained. There is no specific protocol presented or followed to evaluate the factors suggested (anoxic conditions, pH) for individual samples.	EPA agrees that eliminating COPCs based on uncertainties that can be resolved in Phase II sampling is inappropriate. Comment will need to be addressed in the revised COPC refinement Technical Memorandum (see GC-6). However, sediment and water quality parameters such as redox and pH are descriptive and not considered in the COPC refinement.	Eliminating COPCs based on uncertainties that can be resolved in Phase II sampling is inappropriate. The revised COPC refinement Technical Memorandum will include analyses of chemicals that are not excluded on the basis of risk. Uncertainties based on "contributing factors" such as exceedances of porewater benchmarks for aluminum and manganese may be due to confounding factors resulting from sample collection and handling (e.g., sampling anoxic porewater, pH)." will need to be resolved as part of collection and analysis methods or in the uncertainty section of the BERA.
13	CCT-App-B-1	Appendix B, 3.3	B-13, lines 6-7	The text states "COPCs not detected in 75% or more of both (emphasis added) sediment and porewater samples…are considered non-risk drivers." However, for example, while bismuth (Bi) was not detected in more than 75% (detected in fewer than 25%) of	EPA agrees that the use of a <25% frequency of detection is inappropriate and will direct Teck to develop a revised COPC refinement in a separate technical memorandum (see GC-6).	EPA does not accept the exclusion of chemicals from further evaluation if their detection frequency is lower than 25%. EPA's Risk Assessment

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				porewater samples, Bi was not detected in 0% (detected in 100%) of sediment samples. There are also some detects in either medium for Be, Nb, Se, Ag, Ta, Tl, Th, and U; in other words, based on the text, all of these elements including Bi should be retained. The exclusion based on frequency of detection needs to be revisited; either the approach needs to be clarified or corrected based on what is given in the text.		Guidance for Superfund describes a 5% or lower detection frequency as a basis for exclusion of chemicals from further evaluation in a baseline risk assessment, a value which should be used in the UCR BERA. Use of the 5% exclusion value requires detection limits being lower than benchmark values for the chemicals being screened. If a chemical's benchmark value is lower than its detection limits, the chemical must be carried through the full BERA process.
14	CCT-App-B-1	Appendix B, 3.3, 4.3	B-12 line 4; B-19 line 3	Why, for inorganic analytes, is a screening criterion of <25% detections (e.g. page B-12 line 4) used, while for organic analytes, a criterion of <5% detections (e.g. page B-19, line 3) is used? Using a less conservative (i.e. higher less-than percentage) excludes more analytes for a given analyte set.		
15	CCT-App-B-1	Appendix B, 3.1	B-5 lines 8-10	Section 3.1, page B-5, lines 8-10. It's stated that the SLERA (TAI 2010a) identified sediment benchmarks for inorganic COPCs "expected to protect at least 95 percent of benthic macroinvertebrate species from chronic toxicity" – after which Table B3-1 is referred to, which includes the TEC and PEC values. For water, AWQC are designed to protect greater than or equal to 95 percent of species, but for sediment this is not an accurate statement. This section should be reworked to accurately describe use of TEC and PEC values for sediment and those derived from EPA's Tier 1 and 2 water quality criteria (which are expected to protect 95%), or clearly use 95% value with reference to water.	EPA agrees that Teck should clarify that the protection of 95% of species applies to NRWQC and not sediment benchmarks. However, the use of a PEC for screening is consistent with EPAs ERA process.	Teck will clarify that the protection of 95% of species apples to NRWQC and not sediment benchmarks.
16	CCT-	Appendix		The overall discussion in section 4 regarding	EPA will direct Teck to develop a revised	If the narcosis-based ESB

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	App-B-2	B, 4.0		refinement of organic analytes of chemicals, including the use of narcosis-based benchmarks and frequency of detection (FOD), needs clarification and has apparent errors. The overall process, beginning with using narcosis-based benchmarks where available, results in the screening out of more analytes than is appropriate, because the narcosis-based benchmarks are significantly higher than the conventional benchmarks. Further, applying a frequency of detection approach (that appears flawed) based on those results ends up screening out all organic analytes. Consistency among and description of tables in this section need to be corrected before the approach described therein can be thoroughly evaluated; however, several comments on and apparent errors in the approach are noted below. Most important, this inconsistency casts doubt upon how exactly the FOD was used to select/eliminate these contaminants. From this review, at a minimum, 2,4'-DDT; 4,4'-DDE; 4,4'-DDT; acetophenone; bis(2-ethylhexyl)phthalate; dimethyl phthalate; endosulfan sulfate; and phenol should be included.	COPC refinement in a separate technical memorandum (see GC-6). EPA agrees that the conventional ESB has a more direct association with toxicity measured in laboratory tests, especially when narcosis is not the primary mode of action. If the narcosis-based ESB is to be viewed to be universally superior to the conventional ESB a justification needs to be provided. Otherwise, detection limits for most organic compounds are inadequate to support the conclusion that they are not risk drivers. The FOD part of COPC refinement will be revised, as stated above.	is to be viewed to be universally superior to the conventional ESB a justification needs to be provided. Otherwise, detection limits for most organic compounds are inadequate to support the conclusion that they are not risk drivers.
17	CCT-App-B-2	Appendix B, 4.1	B-19, Table B4-4.	"All detection limits were less than benchmarks [sic] values…as shown in Table B4-4" is not accurate based on the information provided in Table B-4. Table B4-4 shows sediment benchmarks compared to maximum detection limits, and many of the maximum detection limits are greater than the benchmark values. The purpose of the table is thus unclear; perhaps it is meant that the maximum measured value is less than	EPA agrees that clarification should be made for NDs > benchmarks.	Table B4-4 shows sediment maximum detection limits greater than benchmarks. This is contrary to the statement made in the text that "All detection limits were less than benchmarks." The revised COPC refinement TM will clarify this

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				the detection limits?		inconsistency.
18	CCT-App-B-2	Appendix B	Table B2-2	The statement "The frequency of detection was less than 5 percent of the total number of samples analyzed for each of the organic chemicals" is inaccurate. In Table B2-2, many chemicals show percent non-detects at <95% (or detection greater than 5 percent) for eight (8) chemicals including: 2,4'-DDT; 4,4'-DDE; 4,4'-DDT; acetophenone; bis(2-ethylhexyl)phthalate; dimethyl phthalate; endosulfan sulfate; and phenol.	EPA agrees that clarification should be made for detection frequencies >5% when Table B2-2 indicates the contrary.	Table B2-2 shows sediment detection frequencies >5%. This is contrary to the statement made in the text that "The frequency of detection was less than 5 percent of the total number of samples analyzed for each of the organic chemicals." The revised COPC refinement TM will clarify this inconsistency.
19	CCT-App-B-2	Appendix B	Tables B4-3 and B4-4	Tables B4-3 and B4-4 have some inconsistencies. Some of the benchmarks shown in Table B4-3 aren't shown in Table B4-4. For example, for the analyte phenol, which has values listed in Table 4-3, has no values in Table B4-4. The analyte acetophenone has a different value in Table B4-3 than Table B4-4. Please correct these and all inconsistencies.	EPA agrees that clarification should be made for inconsistencies among tables.	Some of the benchmarks shown in Table B4-3 aren't shown in Table B4-4. For example, for the analyte phenol, which has values listed in Table 4-3, has no values in Table B4-4. The analyte acetophenone has a different value in Table B4-3 than Table B4-4. This and other inconsistencies must be clarified in a revised COPC refinement TM.
20	CCT-App-B-2	Appendix B, 4.1	Table B4-1	Reference to the SLERA identifying one organic chemical with a sediment benchmark isn't clear. Table 4-1 of the SLERA (TAI 2010a) shows TEC, SQS, LAET or Tier 2 ESGs for multiple organic chemicals; Table B4-1 (referenced in this Appendix) indicates 4 Tier 1 values and the rest Tier 2. Please clarify.	EPA agrees that clarification should be made.	Reference to the SLERA identifying one organic chemical with a sediment benchmark isn't clear. Table 4-1 of the SLERA (TAI 2010a) shows TEC, SQS, LAET or Tier 2 ESGs for multiple organic chemicals; Table B4-1 (referenced in this Appendix) indicates 4 Tier

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						1 values and the rest Tier 2. This inconsistency must be clarified in a revised COPC refinement TM.
21	CCT-App-B-3	Appendix B, 3.1	B-5, lines 11-13	Sentence needs to be rewritten	It is not clear how sentences are incomplete or should be re-written. "In addition, reproductive endpoints will be evaluated on 12 split -samples." "Preference for these 12 split with will be given to sampling stations located within high-medium exposure gradients." "Specific bioassays to be performed on these 12 split-samples include the following:"	-
22	CCT-App-B-3	Appendix B, 5; 3.3	B-21, line 5 and page B-22, line 2; section 3.3, page B-13, line 19; page B-13, line 33 and page B-14, line 8	Change "insure" to ensure	EPA agrees.	Change "insure" to ensure
23	CCT-App-B-3	Appendix B, 3	B-5, line 2	Change "organic" to inorganic	EPA agrees.	Change "organic" to inorganic.
24	CCT-App-B-3	Appendix B, 3	B-5, line 3	Change "reasonably" to reasonable	EPA agrees.	Change "reasonably" to reasonable.
25	CCT-App-B-3	Appendix B	B-16, footnote	Footnote isn't clear.	Can CCT please comment on what specifically is not clear and what direction	Pending clarification from CCT

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			14		<mark>is needed in the comment?</mark> EPA may agree with CCT if the intent of this comment is to ask for clarification and references explaining why "COPC concentrations in media will be lower than predicted" if they are not in equilibrium.	
26	CCT-App-C	Appendix C		With EPA's direction, Teck Cominco has evaluated existing sediment data for the UCR site and used this information to determine sampling locations for the Phase 2 Sediment Study. The EPA's LOE paper had indicated that Teck should separate samples into 4 "bins" or categories, which would include: • External reference sites • Sites with low levels of metals • Sites with moderate levels of metals • Sites with high levels of metals The EPA directed Teck to categorize sediment samples by sediment chemistry, using the following criteria: • Mean probable effect concentration quotient (mPECQ). PECQ is the quotient of the concentration of a substance (here metals) measured in sediment to the Probable Effect Concentration (PEC) as derived in MacDonald et al (2000). PECs represent the level above which adverse effects are expected to occur. Mean PECQ is the sum of quotients for different metals divided by the number of quotients. • SEM-AVS. A way to measure the	EPA agrees that the bins described in the LOE had numeric criteria while Teck's bins differ, as shown in Appendix C, Figure 2-3. They do, however, cover the types of measurements suggested in the LOE (TOC, mPECQ, a measure of slag). This comment may be moot anyway: EPA is waiting to see the final approved sample locations, but is inclined to go with the group's recommendation and direct Teck to amend the QAPP to adopt the locations proposed by the work group. This should result in a higher success rate because local expert knowledge is being used to hand-place samples in areas where sampling success is more likely, and because a generous number of alternate locations will be included (see GC-2 and GC-5).	<mark>Pending discussions with PPs.</mark>

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				bioavailability of measured contaminant concentrations to organisms. Simultaneously extracted metals minus acid volatile sulfide, which is defined as "excess" SEM. • SEM-AVS/foc. Another way to measure bioavailability. The above (SEM-AVS) divided by the fraction of organic carbon. Emphasis was placed on using the mPECQ as the primary criterion in order to have the categories represent areas expected to have low, medium, or high metals concentrations. However, in the QAPP, the following criteria were actually used by Teck to categorize existing sediment data: • Zinc to vanadium ratios (Zn/V). Supposed to approximate the amount of slag in a sample. • Total organic carbon (TOC). As one measure of the bioavailability of metals. • mPECQ. Data were filtered first by Zn/V, then by TOC, and finally by mPECQ. We have a number of concerns about the way the bins were created by Teck:		
27	CCT-App-C-1	Appendix C		Teck filtered sediment data using three different criteria, yet mPECQ was the last filter used. The mPECQ criterion is the one presumed to most closely estimate the	EPA agrees with CCTs concerns over the need for a robust, flexible, and well defined sampling plan with a high likelihood of success. EPA is waiting to see the final	<mark>Pending discussions with PPs.</mark>

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				potential toxicity of UCR sediments to benthic organisms, which is the primary goal of the Phase 2 Sediment Sampling. By using it as the last filter, it is given the least importance. Mean PECQ should be given greater weight in the categorization of sediment samples. It should be the primary filter used to identify bins for Phase 2 sampling locations.	approved sample locations, but is inclined to go with the sampling location discussion group's recommendation and direct Teck to amend the QAPP to adopt the locations proposed by the work group. This should result in a higher success rate because local expert knowledge is being used to hand-place samples in areas where sampling success is more likely, and because a generous number of alternate locations will be included (also see GC-2 and GC-5).	
28	CCT-App-C-2	Appendix C	C-9	The EPA's LOE paper recommended the use of specific mPECQ values to distinguish between bins representing high, medium, and low levels of metals contamination. However, Teck has used different values. The thresholds proposed by Teck negate the use of the bin system because it eliminates the gradient in mPECQ values that are intended to help develop site specific concentration-response relationships (CRRs). It also fails to properly identify those sediments expected to be most toxic. Teck should adopt the thresholds proposed by the EPA in their LOE paper as these thresholds will better estimate the range of sediment conditions experienced by benthic invertebrates. Teck currently indicates in the QAPP that the "bins for mPECQ values were developed based on discussions between the EPA-led government team and Teck during Jan 10-11, 2010 meeting in Seattle" (p. C-9), however the EPA's LOE paper with its current recommendations was released in February 2010. See the table below for relative distribution of the sample locations Teck has proposed in its own bins	EPA agrees that an mPECQ of 5 or higher should be used to identify samples most likely to be toxic.	-

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				vs. the bins defined in the LOE. Teck's sample locations (including reserve locations) are weighted toward the low end of the predicted mPECQ range, with 42 out of the 90 proposed locations falling below an mPECQ of 1. While the bins may be filled in subsequent rounds of sampling, the CCT would like to see a greater emphasis on samples from areas with predicted mPECQs greater than 1, although we acknowledge that the Kriged prediction will not be perfect (see next comment below).		
29	CCT	Appendix C		Teck has not used all the sediment data at its disposal in creating its Kriged sediment property maps. The CCT examined data from surface samples from cores taken by the CCT and Teck as part of the ongoing Pakootas litigation, and found that out of 12 samples, the Kriged mPECQ differed from the empirical measurement by 24 – 1873%. In about half the cases, the samples would end up in different mPECQ "bins" (6 if using Teck ranges, 4 if using LOE ranges). Errors were in both directions; that is, areas Kriged as low-mPECQ yielded samples with high metals concentration, and vice versa. While it is true that Kriging will never yield a 100% successful prediction given the current sample density in the UCR, Teck is in possession of samples that could go quite a ways in filling some of the existing gaps, namely, the unpermitted sediment samples taken for analysis by their experts for the Pakootas litigation. We recommend that Teck be required to make use of these samples to increase the accuracy of surface sediment contamination predictions in the UCR and Lake Roosevelt.	EPA contends that validated data should be used for sample planning at this time. Additional data, such as those obtained by the PPs and those obtained by Teck without permit can be reviewed by EPA and validated for inclusion in the RI as we proceed, possibly informing future sampling rounds. EPA recognizes the uncertainties associated with the kriged concentrations mapped by Teck.	-

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30	CCT	Appendix C		The mean PECQs derived by Teck include only lead, zinc, cadmium, and copper, which Teck identifies as the "primary risk drivers."[1] Notably absent from this list, considering the history of contamination in the UCR, are mercury and arsenic. Mercury was considered a COPC because the 90th percentile mercury concentration in sediment exceeded the PEC, but not a "primary driver" because the porewater concentration did not exceed its benchmark (Appendix B, page B-2). However, the PEC for mercury could not be validated in MacDonald et al. (2000) because there were insufficient data, and the study's authors suspected that a lower (more conservative) PEC value may have had better predictive accuracy. It would be more appropriate to (1) use a lower sediment quality guideline (SQG) for mercury, such as the probable effect level (PEL) listed in MacDonald et al. (2000), and (2) include mercury in the mPECQ calculations (using the appropriate SQG value) used to categorize existing sediment data.	DOI has commented that: "Hg and As are not reliable PECs and were not used by MacDonald et al.(2000) to calculate mean PEC-quotients for metals." An appropriate PEC (other than the questionable value presented in MacDonald et al. 2000) would need to be proposed and accepted by EPA before PECs for mercury can be calculated. However, this comment may be helpful to Teck in the RI and for data evaluations and will be forwarded by EPA.	The following comment is being provided for Teck's information, no response needed.
31	CCT	Appendix C		The EPA's LOE identifies the SEM-AVS and SEM-AVS/foc methods as being appropriate for targeting sample collection into bins. Rather than using either of these methods to	Three measures of metal bioavailability were provided to Teck in the LOE as suggested methods for binning samples "(e.g., mean PEC-Qmetals 0.2 to 1.0;	-

[1] Further information about why Teck only included 4 metals in its mPECQ calculations is given only in a footnote in Appendix C: "As described by MacDonald et al. (2000), mPECQ values are defined based on eight metals – arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. For UCR sediment gradient analyses, mPECQ values were approximated using measurements for the four primary metal risk drivers – zinc, copper, lead, and cadmium. The remaining metals are not expected to be significant components of overall mPECQ values and are not expected to be contributors to site risks for sediments. PECQ values for arsenic, chromium, mercury, and nickel are usually lower than for zinc, copper, lead, and cadmium. Also, mPECQ values approximated using the four primary metals are typically greater than values calculated for all eight metals because the sums of PECQ values are divided by four rather than eight. For example, mPECQ values for the four primary metals average 2.04 and a have a maximum of 22.44 while values for eight metals average 1.14 and have a maximum of 11.63."

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				evaluate metals' bioavailability in sediment samples, Teck has used TOC as its criteria. TOC is also a way to evaluate bioavailability because metals will bind to organic material as they will bind to sulfides (as measured by AVS) to create insoluble metal sulfides. However, because SEM-AVS/foc includes a measure of the metal concentrations as well as the binding material, it seems a more appropriate measurement to use to categorize sediment samples than TOC. It is recommended that Teck employ the SEM-AVS/foc method as a second filtering criterion (after mPECQ) for evaluating sediment locations. This was suggested by the EPA. At the very least, a discussion should be included in the QAPP about the effects of using TOC as opposed to SEM-AVS/foc.	SEM-AVS <1.7 µmole/g; SEM-AVS/fOC). One of the methods (PECQ) was used by Teck in their approach and it was reasonable to do so, as too many bins would make sample locations selection needlessly complex. Teck will be required to collect AVS, SEM, and TOC in all samples to use in interpreting data from round 1 and, if these are useful measures for explaining data, these data driven indicators can be used to inform future rounds of sampling. This comment may be moot anyway: EPA is waiting to see the final approved sample locations, but is inclined to go with the group's recommendation and direct Teck to amend the QAPP to adopt the locations proposed by the work group.	
32	CCT	Appendix C		The other criterion used to categorize sediment samples was Zn/V. It appears that Teck is trying to develop a predictor of the slag content of sediment using this criterion. However, characterization of slag should occur after sampling, not to pre-determine sampling locations, and, as stated in the general comments, should have a basis in empirical measurement as opposed to extrapolation from metal ratios. In addition, because Teck's analysis indicates that Zn/V ratios and mPECQ values are highly correlated (r2 = 0.914), use of the mPECQ criterion should suffice. We recommend that the Zn/V criterion is not used to identify sampling locations.	EPA appreciated Teck's attempt to include a measure of slag in their sampling binning process, in accordance with the LOE recommendation to consider other factors in the binning process. It may not be the best method for slag characterization, but has shown to be reasonable and provides a factor partially helping to explain Phase I sediment toxicity data (Ecology 2011).	-
33	CCT	Appendix C	C-14, C-18	On pages C-14 and C-18, description of creation of a mapping layer related to	While EPA agrees with CCT that the reason for discussing and creating a GIS	Clarify the rationale for creating a mapping layer

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				sediment grain size is discussed. However, it is not clear from the text or maps what role, if any, this layer played in Teck's selection of proposed sediment sample locations. If this categorization played a role in location selection, that should be made more explicit. However, it is the CCT's position that this parameter should not play a role in sample location selection, and that maps containing this layer should be revised to remove it, because as currently drawn it obscures more important sediment classification layers.	layer with grain size is not clear, EPA still finds this information helpful and consistent with the LOE. The consideration of 'other' factors when selecting sediment sample locations was indicated in the LOE.	related to sediment grain size.
34	CCT	Appendix C	Table 2-7	Table 2-7 in Appendix C should be amended to include the number of samples proposed to be located in each sediment category.	A DQO describing the purpose of sediment samples and toxicity testing must be included in the revised QAPP, including the approximate total number of samples expected to meet the DQOs, while recognizing that the final determination will be data driven. EPA supports targeting 100-130 samples representing a range of concentrations and conditions to develop concentration response relationships (see GC-5). EPA agrees that the QAPP must state the number of samples to be located in each category. This comment may be moot anyway: EPA is waiting to see the final approved sample locations, but is inclined to go with the group's recommendation and direct Teck to amend the QAPP to adopt the locations proposed by the work group.	<mark>Pending discussions with PPs.</mark>